FISH OF TIMBALIER BAY AND OFFSHORE LOUISIANA ENVIRONMENTS COLLECTED BY TRAWLING

by Allison Perry

ABSTRACT

Trawlings were made for fish in the vicinity of a drilling rig and production platform, and at a control site in Timbalier Bay and off Grand Isle, Louisiana, to determine whether or not oil activities have had any significant effect on fish populations. Species diversity was highest at the control site and lowest at the drilling site in Timbalier Bay; however, biomass was highest at the drilling site and lowest at the production platform. At the offshore area the drilling site had the highest species diversity and the production site had the lowest. The highest biomass was measured at the control site and the lowest at the production site.

Earlier studies of fish populations pre-dating oil activities were similar to these findings, indicating that oil production has not had an adverse effect on fish populations.

INTRODUCTION

The effect of oil drilling and production activities on fish populations in the Gulf of Mexico has been a topic of subjective discussion for many years. To date there have been no published accounts of objective survey work using bottom nets to sample the fish populations in oil production tracts. Therefore, this investigation was designed to determine by trawl survey whether normal offshore drilling

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and production operations have had any significant effect on the ecology of estuaries or continental shelf areas as related to the various bottom fish populations in the Grand Isle, Louisiana, petroleum activity regions.

The first studies of trawl catches of fishes in the Gulf of Mexico were made by Gunter from 1931 to 1933 (Gunter 1936, 1938a, 1938b). His collections were made in Barataria Bay and the adjacent Gulf. Fish counts were made monthly over the seasons, and the data were used in various analyses. They were also used to compare with similar data collected later in Texas waters where total lengths, as well as counts, were made of all fish. The data from the two different areas enabled Gunter to compare the fish populations of Louisiana and Texas shallow Gulf waters (Gunter 1941, 1945). These original studies were located near Timbalier Bay and covered a salinity gradient similar to that of the present study. These previous studies by Gunter enabled us to compare present fish populations with those collected in the 1930s to determine whether or not there has been an adverse effect from oil activities in the ensuing years.

MATERIALS AND METHODS

Samples of the bottom-dwelling fish were collected in Timbalier Bay with a 4.9-meter trawl provided with 2.9 cm webbing and a 0.6 cm mesh tail liner. Samples off Grand Isle were taken with a 9.1 m trawl provided with a 2.9 cm mesh net. Nektonic fish within the bay were collected with a 0.9 × 1.2 m frame and offshore with a 1.2 × 2.4 m frame. The nets in each case consisted of 0.6 cm mesh in the body and 0.3 cm mesh at the tail.

All nets were towed for a period of 20 minutes. The fish were fixed in 10% formalin and transported to the laboratory. Specimens were identified to species and counted, and lengths and weights were measured for up to 100 specimens per species per tow. Collections were made over an 18-month period from August 1972 through January 1974, with 26 tows taken in Timbalier Bay and 14 from offshore waters (table 1). Data were analyzed according to relative apparent abundance (Marr 1951), species diversity (Wilhm 1968), species redundancy (Kohn 1966), and biomass.

Samples were taken upstream and downstream from a drilling site and a production platform, and at a selected control site. Drilling activities within the bay were rarely at the same site from one collection period to the next, necessitating changing locations from time to time. The Philo Brice Island platform was used for the bay production station, and the control station was located at Wrong Name Pass. There were three sites used in the offshore sampling program. The drilling rig, HOR-ST-

TABLE 1

Number of Species and Specimens of Fish from

Timbalier Bay and Offshore Waters of Louisiana

Species	Timbalier Bay				Offshore Waters				Totals of all Stations
	Drilling Upcurrent	Drilling Downcurrent	Production	Control	Drilling Upcurrent	Drilling Downcurrent	Production	Control	
Anguilliformes, larvae		1	6	9			1	3	20
Anchoa hepsetus	2	5	35	23		8	17	117	207
A. lyolepis				8					8
A. mitchilli	9620	7463	8728	3808	2			12	29,633
A. sp., larvae								5	5
Arius felis	18	9	26	28	72	69	225	14	461
Antennarius radiosus					2	4		16	22
Bagre marinus	2		71	9					82
Bairdiella chrysura	6		2	22					30
Balistes capriscus					1		1		2
Brevoortia patronus	12	4	7	35					58
Caranx hippos			1			1		1	3
Centropristis philadelphicus					7	7	9	1	24
Chaetodipterus faber	1		14	10	11	12	111	5	164
Chloroscombrus chrysurus	2	5	43	14			2	20	86
Citharichthys spilopterus	1	1	9	8	1		1	3	24
Clupeidae, larvae	2		155	25					182
Cynoscion arenarius	10	9	84	13	82	67	8	40	313
C. nebulosus			1						1
C. nothus	1				56	77	14	226	374
Dasyatis sabina	1								1
Dorsoma cepedianum			1						1
Etropus crossotus	4	2	29	22	77	76	26	157	393
Halieutichthys aculeatus					3	5	3	6	17
Harengula pensacolae	1	1	5					1	8
Lagodon rhomboides						2	5		7
Larimus fasciatus			2		3	5	6	9	25
Leiostomus xanthurus	3		12	28	26	56	92	42	259
Lutjanus campechanus					2		19		21
Membras martinica	2	1		1					4

TABLE 1 (continued)

Species	Timbalier Bay				Offshore Waters				Totals of all Stations
	Drilling Upcurrent	Drilling Downcurrent	Production	Control	Drilling Upcurrent	Drilling Downcurrent	Production	Control	
Menticirrhus americanus				2	1	2	1	3	9
Micropogon undulatus	4	3	251	617	42	78	122	764	1881
Mugil curema		1							1
Ogcocephalus parvus						1			1
Ophisthonema oglinum	1		2	2			1		6
Orthopristis chrysoptera						2	2		4
Paralichthys lethostigma					2	3	1		6
Peprilus alepidotus				2	1				3
P. burti		1	67	30		1	9	68	176
Polydactylus octonemus			24	4			12	13	53
Pomatomus saltatrix				1			1	1	3
Pontinus longispinis					1			1	2
Porichthys porosissimus					1	1		1	3
Prionotus roseus						1			1
P. rubio			1	2	3	8	7	32	53
P. scitulus			1	1					2
P. sp., larvae				1				2	3
P. tribulus		1	5	4				2	12
Rhizoprionodon terraenovae			1						1
Sciaenidae, larvae	1								1
Scomberomorus maculatus	1			5					6
Sphoeroides parvus	3	5	45	20	7	6	12	40	138
Stellifer lanceolatus			1		2	8		35	46
Stenotomus caprinus							3		3
Syacium gunteri					2	8	2		12
Symphurus civitatus					10	5		36	51
S. plagiusa	1	1	3	1	27	17	4	30	84
Syngnathus louisianae				1					1
Synodus foetens	2	3	2	2		4	1	6	20

TABLE 1 (continued)

Species	Timbalier Bay				Offshore Waters				Totals of all Stations
	Drilling Upcurrent	Drilling Downcurrent	Production	Control	Drilling Upcurrent	Drilling Downcurrent	Production	Control	
Trachurus lathami					1			2	3
Trichiurus lepturus	42	6	45	29	22	23	47	529	743
Urophycis floridanus					1	1		1	3
Vomer setapinnis	9	9	3	18	11	12	7	14	83
Total Number of Species	26	20	33	34	30	31	32	37	63
Total Number of Specimens	9752	7531	9682	4805	479	570	772	2258	35,849
Number of Trawls	4	4	9	9	2	2	5	5	40
Relative Apparent Abundance	2438	1883	1076	534	240	285	154	452	896
Species Diversity	1.62	1.84	2.18	2.90	6.33	8.01	3.81	3.95	-
Species Redundancy	0.69	0.77	0.65	0.55	0.29	0.23	0.28	0.50	-
Biomass (g/ha)	3019.	1922	1577	1795	7377	8876	5772	11,565	-

54E, was used twice for the drilling station before it ceased operation. The platform HOR-ST-54A (called Exxon 54A in other papers in this volume) was used for the production site, and the control station was located 5.3 nautical miles northeast of 54A in an undisturbed area.

RESULTS

The data for the fish collected in the 40 trawls are summarized in table 1 according to species, number of specimens, relative apparent abundance, species diversity, species redundancy, and biomass. Table 2 ranks the most commonly encountered fish according to the type of petroleum activity in Timbalier Bay and offshore waters. A total of 35,849 specimens in 63 species was collected from both areas during the 18-month period. *Anchoa mitchilli* accounted for nearly 83% of the catch, most of which were taken from Timbalier Bay. If this species is excluded from the total fish catch, then only 2,131 specimens were collected from the bay as compared to 4,055 from offshore. Forty-seven species were taken in offshore waters and 43 from Timbalier Bay; 32 species were common to both areas. The number of species was largest from both control stations followed by the production site; however, none of the species unique to the control site was present in large numbers. If the number of specimens of *Anchoa mitchilli* is excluded, then the numbers of specimens collected from Timbalier Bay sites become 111 and 106 per trawl at the control and production site, respectively, as compared to 17 and 33 per trawl at the drilling platform. Nearly twice as many specimens were taken from the control site at the offshore locality as from the drilling and production sites. The species diversity and biomass were considerably higher at the oil offshore stations compared to the bay.

Anchoa mitchilli was the dominant fish at all localities within the bay (table 2). *Micropogon undulatus* was the second most common species, at both the production and control stations.

There was a greater degree of species variability among production platform, control stations, and bay stations than between the offshore stations. The greatest variability at the offshore stations was within the dominant species, *Micropogon undulatus*.

DISCUSSION

The bay anchovy, *Anchoa mitchilli*, was the most abundant species in the bay and was the largest contributor to the biomass. The croaker, *Micropogon undulatus*, cutlass fish, *Trichiurus lepturus*, and the white

TABLE 2

Ranking of Most Abundant Species by Station*

Species	Timbalier Bay				Offshore Waters			
	Drilling Upcurrent	Drilling Downcurrent	Production	Control	Drilling Upcurrent	Drilling Downcurrent	Production	Control
Anchoa hepsetus			10	9			8	5
A. mitchilli	1	1	1	1				
Arius felis	3			6	3	4	1	
Bagre marinus			5					
Bairdiella chrysura				10				
Brevoortia patronus	4			3				
Chaetodipterus faber					9	9	3	
Chloroscombrus chrysurus			9					
Clupeidae, larvae			3	8				
Cynoscion arenarius	5		4		1	5		
C. nothus					4	2	9	3
Etropus crossotus				10	2	3	6	4
Leiostomus xanthurus				6	7	6	4	
Lutjanus campechanus							7	
Micropogon undulatus			2	2	5	1	2	1
Peprilus burti			6	4				6
Polydactylus octonemus							10	
Prionotus rubio								10
Sphoeroides parvus			7				10	7
Stellifer lanceolata								9
Symphurus civitatus								8
S. plagiusa					6	8		
Trichiurus lepturus	2		7	5	8	7	5	2
Vomer setapinnis					9	9		

*Based on a minimum of 10 specimens per station

trout, *Cynoscion arenarius*, were the next important species. These fish were the most important fish in Caminada Bay, Louisiana (Wagner, in Stone 1972), Barataria Bay, Louisiana (Gunter 1938b; Behre 1950), Terrebonne and Timbalier Bays, Louisiana (Perret et al. 1971), Copano and Aransas Bays, Texas (Gunter 1945), Alabama bays (Boschung 1957; Swingle 1971), and Mississippi bays (Christmas and Waller 1973). Drilling activities seemed to affect the fish populations in shallow Timbalier Bay as indicated by the lower catches and lower species diversities at these stations; however, these lower figures are apparently only temporary during drilling operations, as indicated by data from the production site.

The offshore fish most frequently caught was the croaker, *Micropogon undulatus*, followed by the cutlassfish, *Trichiurus lepturus*, hard-head catfish, *Arius felis,* the silver seatrout, *Cynoscion nothus,* and the white trout, *Cynoscion arenarius*. Hildebrand (1954) analyzed the catch of shrimp boats that had trawled in the same general area, and he reported that the croakers and cutlass fish were the dominant species, followed by the two species of sea trout. He caught many more specimens of the blackfin searobin, *Prionotus rubio*, but this was probably because his trawls were from deeper waters. Moore et al. (1970) found the croaker to be the most abundant species along the Louisiana coast. Gunter obtained similar results in trawling studies south of Grand Isle, Louisiana.

Several species of fish were more common downcurrent from the rig in the path of overboard discharge than upcurrent in cleaner waters. These fish include the silver seatrout, spot, croaker, and the moonfish, *Vomer setapinnis*. No explanation is offered to account for this difference.

CONCLUSIONS

Comparisons of this 18-month fish trawling study in Timbalier Bay and offshore waters to present work in similar habitats of the northern Gulf region are in agreement. While there seems to be some disruptive effect on fish populations as a result of drilling, especially within Timbalier Bay, this adverse effect was localized and temporary, as shown by the similarity of the present fish populations to those of 20-40 years ago and the greater number of fish present around production platforms. Lower biomass values measured around both the bay and offshore production platforms may be due in part to the compact sediment present around rigs, from which normal infauna of soft bottom substrata would be excluded. Such an exclusion would result in lower benthic biomass values, which in turn would result in lower food availability for

fish. High barium concentrations, which are indicative of oil drilling, were reported by Chan and Hanor (1973) near production platforms.

REFERENCES CITED

Behre, E. H. 1950. Annotated list of the fauna of the Grand Isle region. Occasional Papers of the Marine Laboratory, Louisiana State University, No. 6.

Boschung, H. T. 1957. The fishes of Mobile Bay and the Gulf coast of Alabama. Ph.D. dissertation, University of Alabama.

Chan, L. H. and J. S. Hanor. 1973. Input of barium into the marine environment as a result of offshore drilling operations. First Annual Report to the Gulf Universities Research Consortium. Department of Oceanography, Louisiana State University.

Christmas, J. Y. and R. S. Waller. 1973. Cooperative Gulf of Mexico estuarine inventory and study, Mississippi: Phase IV-Biology. Gulf Coast Research Laboratory, pp. 320-434.

Gunter, G. 1936. Studies of the destruction of marine fish by shrimp trawlers in Louisiana. Louisiana Conservation Review **5**:18-46.

———. 1938a. The relative numbers of species of marine fish on the Louisiana coast. American Naturalist **72**:77-83.

———. 1938b. Seasonal variations in abundance of certain estuarine and marine fishes in Louisiana, with particular reference to life histories. Ecological Monographs **8**:313-346.

———. 1941. Relative number of shallow water fishes of the Northern Gulf of Mexico with some records of rare fishes from the Texas coast. American Midland Naturalist **26**:194-200.

———. 1945. Studies on marine fishes of Texas. Publications of the Institute of Marine Science, The University of Texas **1**:1-190.

Hildebrand, H. H. 1954. A study of the fauna of the brown shrimp (*Penaeus aztecus*, Ives) grounds in the western Gulf of Mexico. Publications of the Institute of Marine Science, The University of Texas **3**:232-366.

Kohn, A. J. 1966. Food specialization in *Conus* in Hawaii and California. Ecology **47**:1041-1043.

Marr, J. C. 1951. On the use of the terms *abundance*, *availability*, and *apparent abundance* in fishery biology. Copeia (1951) **2**:163-169.

Moore, D., H. A. Brusher, and L. Trent. 1970. Relative abundance, seasonal distribution, and species comparison of demersal fishes off Louisiana and Texas, 1962-64. Contributions in Marine Science, The University of Texas **15**:45-70.

Perret, W. S., W. R. Latapie, J. F. Pollard, W. R. Mock, G. B. Adkins, W. J. Gaidry, and C. J. White. 1971. Section I. Fishes and invertebrates collected in trawls and seine samples in Louisiana estuaries. Cooperative Gulf of Mexico Estuarine Inventory and Study, Louisiana, Phase IV-Biology. Louisiana Wildlife and Fisheries Commission, pp. 41-105.

Stone, J. H. 1972. Louisiana superport studies: Report 2—Preliminary assessments of the environmental impact of a superport on the southeastern coastal area of Louisiana. Center for Wetland Resources, Louisiana State University. LSU-SG-72-05.

Swingle, H. A. 1971. Biology of Alabama estuarine areas—Cooperative Gulf of Mexico estuarine inventory. Alabama Marine Resources Bulletin **5**:1-123.

Wilhm, J. L. 1968. Use of biomass units in Shannon's formula. Ecology **49**:153-156.